BOTANICAL SURVEY OF THE ALKALI LAKE AREA
BLACKFEET NATION

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EXECUTIVE SUMMARY

Systematic survey of the vegetation and flora was conducted around Alkali Lake, a large alkaline basin system below the foothills of the Rocky Mountains noted as harboring the westernmost population of piping plover (*Charadrius melodus*) range wide. The purpose was to contribute a landscape perspective to site management planning, also identifying any exotic plant problems and additional species or communities conservation opportunities.

Seventeen vegetation types were sampled including nine wetland types. One of the regionally rarest types present, or at least under-documented types in the northern Great Plains, is the locally extensive grassland plant association of western wheatgrass- alkali bluegrass (*Agropyron smithii - Poa juncifolia* p.a.*)*. None of the rare wetland species that were sought occur here, but two upland species that are regional endemics and which had once been recognized as species of special concern were documented, contracted indian ricegrass (*Oryzopsis contracta*) and rabbit-foot crazyweed (*Oxytropis lagopus* var. *conjugens*). Vegetation and botanical features contribute to the Alkali Lake biodiversity significance.

ACKNOWLEDGEMENTS

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INTRODUCTION

Systematic survey was conducted of botanical features in the Alkali Lake wetland complex, an 8,000 acre study area below the foothills of the Rocky Mountains. This prairie pothole site is among the largest alkaline wetland systems along the Rocky Mountain Front, harboring the westernmost population of piping plover (*Charadrius melodus*) range wide as well as breeding colonies of American white pelican and double-crested cormorant.

Vegetation sampling and mapping were completed, and plant species of special concern were inventoried. While the piping plover's typical shoreline nesting habitat is devoid of vegetation, the surrounding vegetation and conditions potentially affect the habitat. The purpose of this study was to contribute a landscape perspective to site management planning, also identifying any exotic plant problems and sensitive plant species conservation opportunities.

A brief literature review of piping plover management research is provided in the study by Smith et al. (1993). The present study is botanical in nature, and does not directly address wildlife management.

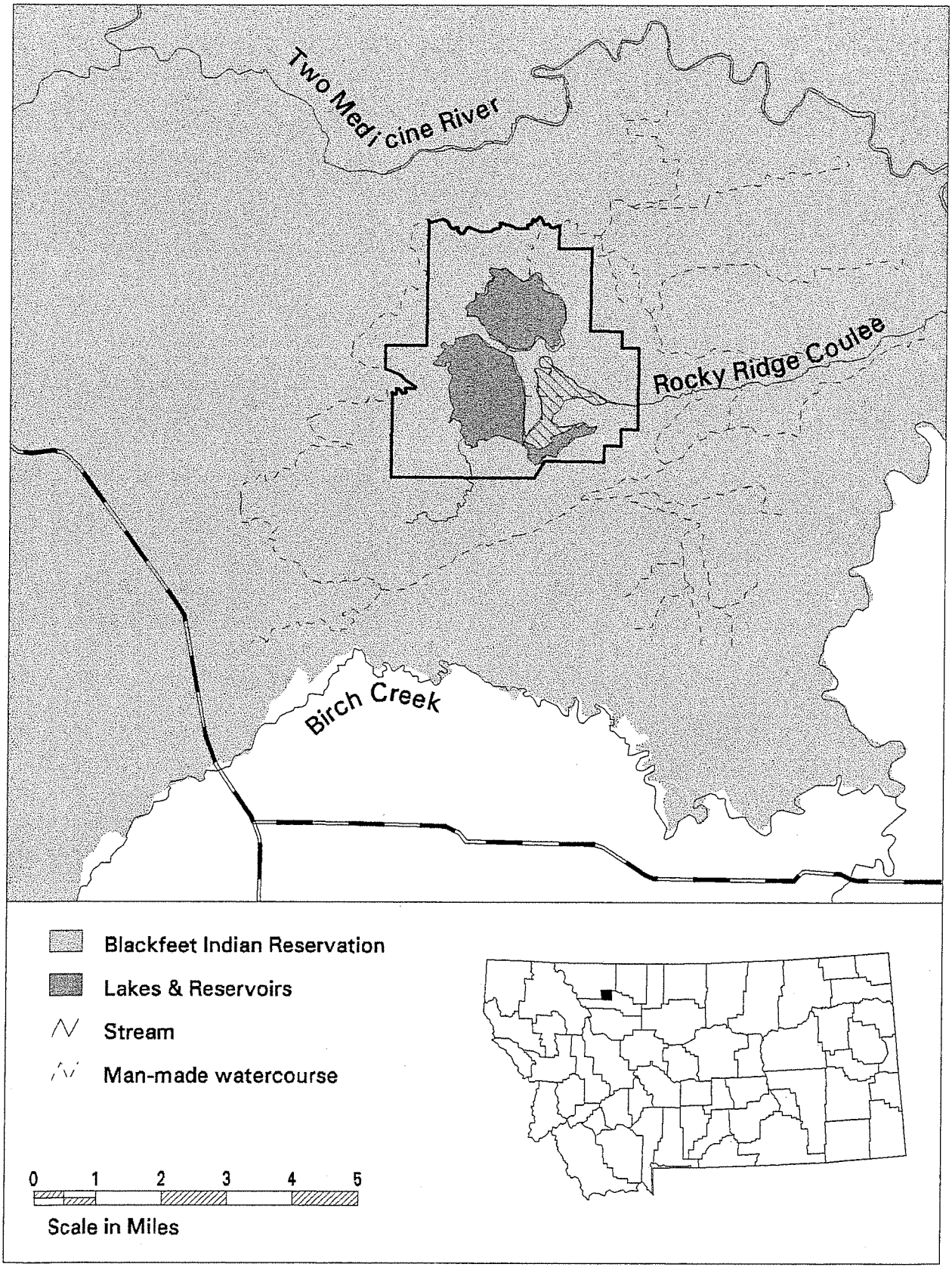
STUDY AREA

The Alkali Lake study area lies on tribally-administered land within the Blackfeet Indian Reservation, in Pondera County (Figure 1). It is located ten miles due northwest of Valier. The wetlands and uplands together span roughly twelve square mile, or 8,000 acres, within four townships: T.7W R.31N, T6W R.31N, T. 7W R.30N, and T.6W R.30N (Figure 1). Alkali Lake is at the low point in the center of the study area, where elevation ranges from app. 3784-3900 feet. The gentle terrain is set off by steep escarpments, or buttes, to the west. Flag Butte is a distinctive landmark, and the study area is within the Flag Butte Quad (U.S.G.S. 7.5').

The setting is one of rolling, poorly drained uplands between the incised valleys of Birch Creek to the south and Two Medicine River to the north. It lies near the outer edges of cordilleran and continental glaciation.

The aquatic system is made up of two large water bodies including Alkaline Lake to the south, and a similar-size unnamed lake to the north. To the southeast of Alkali Lake is a wetland system that had once been an arm of Alkali Lake. Alkali Lake has several natural inlets, and represents the low point in a closed-basin watershed. The two large water bodies were originally semi-permanent wetlands in the sense of Cowardin et al. (1979), i.e., collecting basins with unique geomorphology and soils (Arndt and Richardson 1988, LaBaugh et al. 1987).

Figure 1. Alkali Lake Study Area



Montana Natural Heritage Program, June 10, 1997

Water body levels of the entire aquatic system have been affected by water diversions including three new water channels, and the creation of a dike between wetlands. The original surface features are shown on the BLM Surface Management Map (Valier 1975; 1:100,00) and the revised surface features are shown on the USGS. map (Flag Butte Quad 1985; 1:24,000). The Badger Fish Main Canal and its branches nearly encircle uplands above the area. Water releases from the canal system into the north lake are made through a trenched channel. The north lake and Alkali Lake were originally divided by a natural isthmus now dissected by a man-made channel. A third channel was dug at the east side of Alkali Lake which directly connects it to Rock Coulee and which drained or partially drained much of the eastern wetland habitat. The remaining shallow wetland habitat southeast of Alkali Lake is cut off by a dike. The relatively high volumes of water coming from the canal have turned the north lake and Alkali Lake systems from semi-permanent collecting basins to permanently-inundated flow-through water bodies. The addition of the canal between Alkali Lake and Rock Coulee has increased the volume of water flowing through the system and decreased the proportion of water that evaporates in place. The first five photographs copied in Appendix B represent the Alkali Lake study area setting discussed in this report.

The Alkali Lake study area is in the middle of the largest landscape containing the Vanda-Absher-Saline land association within Glacier and adjoining Pondera counties (USDA 1980). These soils are fine, montmorillonitic soils derived from Colorado Shale that have little soils development. They are classified entisols (Ustic Torriorthents) and aridisols (Borollic natrargids), respectively. The soils mapping units which cover the largest proportion of the study area are:

1. Vanda clay, the most extensive upland soils mapping unit. It is restricted to the east and south sides, and is a dense clay range site.

2. Absher complex and Saline lands, collectively the two most extensive lowland units, encircle the wetlands as shorelines, drainage courses and flats. They represent dense clay and saline lowland range sites.

3. Unmapped soil areas corresponding to open water.

Clay soils are ubiquitous except at the west and north ends where there are gravelly loams and, to a lesser extent, loams or very sandy loams. All of the soils are within the pH 7.4-9.0 range, but only the Absher complex, saline land, and the "playa unit" adjoining Alkali Lake are saline, i.e., with high concentrations of soluble salts.

Climate of the area is continental, with 12-14 inches of precipitation, of which most comes as rain. Evapotranspiration approaches or exceeds precipitation, and strong winds are typical for the region, particularly as chinook winds (USDA Soil Conservation Service 1980).

The vegetation is contiguous native grassland surrounding the wetland complex, with a small area of shrubland, a small tamegrass area in Section 29, and a partially-drained wetland in Sections 31 and 30; discussed in study results on p. 7.

METHODS

Prior to fieldwork, information sources were checked for records of significant biological features. Observations compiled in a preliminary Montana Natural Heritage Program inventory (DeVelice 1993) indicated the presence of vegetation features which might be unusual or in other ways noteworthy. The three records included: *Agropyron smithii-Stipa viridula* plant association, *Agropyron smithii-Poa juncifolia* plant association, and *Hordeum jubatum* community type.

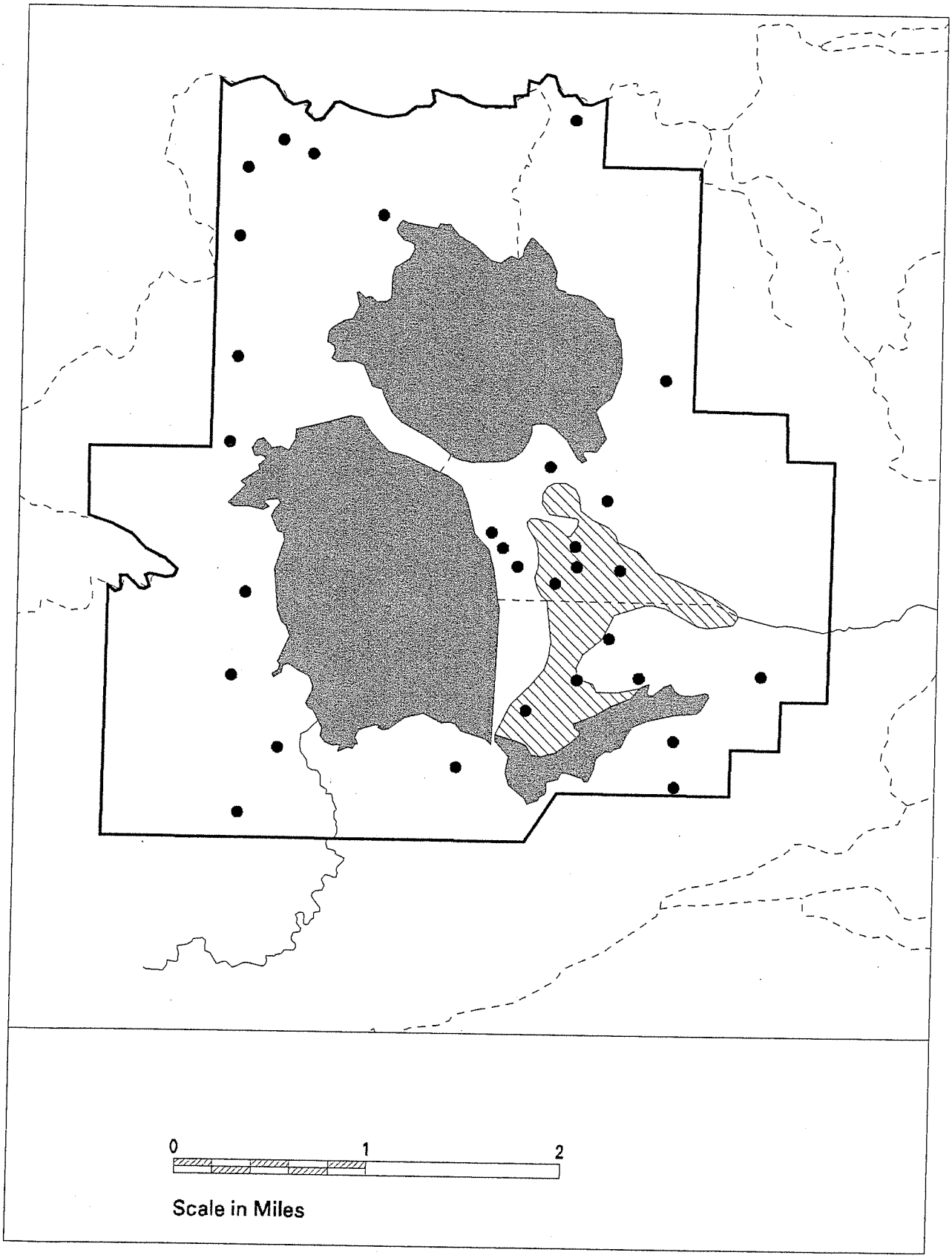
Records of sensitive plant species were not known from the area, yet sensitive species have been documented elsewhere in prairie pothole systems. A list of the species of special concern includes many-headed sedge (*Carex sychnocephala)*, Craw's sedge (*Carex crawei),* and longsheath waterweed *(Elodea longivaginata);* and under-documented species includes Nevada bulrush (*Scirpus nevadensis*) and slender arrowgrass (*Triglochin concinnum* var. *debile*) as representing the initial target list for inventory. The above target species are wetland species.

Vegetation and site characteristics were documented for 30 plots (Figure 2) according to methodology described in Cooper et al. (1995). The plots were selected to sample the plant communities and to represent the spectrum of topographic settings and lithologies across the area. Plant community fieldwork is typically focused on select community types which are the most rare range wide or the best examples. It was expanded in this study to provide a management baseline. Fieldwork was conducted during July 14-17 and 24-25.

In the course of all fieldwork phases, lists of the general flora of the Alkali Lake study area were compiled (Appendix A). Photographs were taken of representative landscape features and the vegetation sample plots (Appendix B). The primary references used to key out plants in the field were Dorn (1984), Hitchcock and Cronquist (1973) , and Great Plains Flora Association (1986). Specimens were collected when field identification was difficult, or when it served to document rare species. Specimens will be deposited at the University of Montana herbarium. Names are generally consistent with the nomenclature used in Hitchcock and Cronquist (1973).

The vegetation sampling data was analyzed using the STRATA program of ECADS (Ecological Classification and Description System), an ecological sampling package (Cooper et al. 1995). Based on their compositional similarity to community types and plant associations of published studies, plots were placed in seventeen groups.

Figure 2. ECODATA Plot Locations at Alkali Lake



Montana Natural Heritage Program, June 10, 1997

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Synthesis and constancy/cover tables were generated for each vegetation type (Appendix C). The tables use six letter acronyms to designate plant species by their scientific name. These are the first three letters of the genus name followed by the first three letters of the specific epithet.

Surveys for sensitive plants were focused on the wetland target species, but the full range of habitat conditions was considered and the uplands were traversed to include the major soils groups. When populations of sensitive plant species of special concern were encountered, field survey forms were filled out, recording pertinent information on habitat (associated vegetation, landscape position, soils), population information, species biology and potential threats.

RESULTS

Seventeen vegetation types and 166 plant species were documented in the Alkali Lake area, including three vegetation types that are not well-documented in the northern Great Plains and two regional endemic plant species of the northern Rocky Mountains which are at the lower elevation limits of their range. Detailed results are presented in two separate sections. The vegetation results are discussed first, followed by the botany results.

Noxious weeds are few in the study area. Canada thistle (*Cirsium arvense*) has reached a high density in a small area on the shore of the north lake corresponding with a fencing project. Treatment potentially serves the dual purpose of bringing the most serious noxious weed under control, and reducing the seed source for Canada thistle as a shoreline invader of piping plover habitat. Musk thistle (*Carduus nutans*) is present in low numbers in lines along cattle trails, and may have the potential to spread. It is not considered a noxious weed in Montana, but has been recognized as such in adjoining states and provinces. Yellow sweetclover (*Melilotus officinalis*) is not considered a noxious weed but has the potential to expand throughout the western uplands. Currently it is present in low numbers at part of the south end perimeter. It would be appropriate to consider potential impacts if there are any future proposals to seed sweet clover on the area or adjoining it. Poverty-weed (*Iva axillaris*) is not considered a noxious weed but is abundant throughout low-lying alkaline areas and some of the upland areas. It is unpalatable and generally considered to be an increaser under grazing. Yet it is native and has wildlife values (Smith 1976). Further evaluation of its status on the landscape is warranted on the part of range conservationists and wildlife biologists in the course of site planning.

VEGETATION RESULTS

Seventeen plant associations or community types were sampled in the Alkali Lake study area (Table 1). They include nine wetland types, and four particularly noteworthy vegetation types that are rare, undocumented or under-documented for the region. The most extensive vegetation type in the uplands of the Alkali Lake study area is the western wheatgrass-alkali bluegrass plant association (*Agropyron smithii-Poa juncifolia* p.a.), and this type is also the least-documented among the seventeen for the northern Great Plains region. A shrubland and a wetland vegetation type are similarly under-documented including the Gardner's saltsage plant association (*Atriplex gardneri* p.a.) and the Nuttall's alkaligrass plant association (*Puccinnellia nuttalliana* p.a.), respectively. Finally, a wetland type of disturbed conditions was documented that has not previously been reported, the meadow barley community type (*Hordeum brachyantherum* c.t.). Open water conditions and associated shoreline flats were also characterized. Each of the vegetation types are described in detail in the following section of this report. They are grouped by community structure (shrubland, grassland, wetland), and sequenced alphabetically by scientific name within the group (exception: the *Agropyron* series). Photographs of most plant associations and community types are presented in Appendix B. → B+W copies avail. in bound copy at Heritage Program.

The vegetation types are grouped into five mapping units corresponding with soils and management considerations as shown in the preliminary vegetation map of the Alkali Lake area in Appendix D. The units include: dense clay range site, other grassland range sites, shrubland, wetland, and drained wetland, and they are mapped on the aerial photograph with soils mapping units as presented in the soil survey (USDA 1980). In addition, there is a small area dominated by crested wheatgrass (*Agropyron cristatum*) that was planted, making up a sixth mapping unit.

There are grassland and wetland plant associations which have not been documented in the Montana literature. Some of these are corroborated by Canadian studies and represent potential additions that warrant extended study, some represent gradients to other plant associations outside the study area. One other "new" association represents a disturbance phase which has not been reported.

Most of the Alkali Lake area vegetation types are characteristic of the Great Plains, while the shrubland types are more characteristic of the Great Basin. This single study area does not provide basis for changing regional classifications and evaluating the range wide status of the component vegetation types. But the results do help frame questions to re-evaluate parts of the classification and expand it in future vegetation keys and treatments.

Table 1 Vegetation Types of the Alkali Lake Area

COMMUNITY	PLANT ASSOCIATION	MAPPING UNIT	CURRENT RANK	PLOT NUMBER
Shrubland	*Atriplex gardneri* p.a.	SHRUBLAND	G3G5/S3	BH023, SC014
	Sarcobatus vermiculatus-Atriplex gardneri p.a.	SHRUBLAND	G4/S3	BH022, SC016
Grassland	*Agropyron smithii-Poa juncifolia* p.a.	DENSE CLAY	G4/S3	BH027, BH039, BH047
	Agropyron smithii-Stipa viridula p.a.	DENSE CLAY	G2/S2	BH048
	Agropyron smithii-Bouteloua gracilis p.a.	(Ecotone)	G5/S4	BH028
	Stipa comata-Bouteloua gracilis p.a.	OTHER RANGE	G5/S5	BH030, BH035
	Stipa comata-Carex filifolia p.a.	OTHER RANGE	G5/S4	BH036, BH040
	Stipa comata-Stipa viridula -	OTHER RANGE	-	BH037
Lowland/Wetland	*Agropyron smithii* p.a.	DENSE CLAY	G4/S4	BH024,BH029
	Carex sartwellii -	WETLAND	-	BH032
	Deschampsia cespitosa p.a.	WETLAND	G4/S4	BH038
	Distichilis stricta p.a.	DENSE CLAY	G4/S4	BH033
	Hordeum brachyantherum/Iva axillaris c.t.	DRAINED WETLAND	-	BH025, BH044, BH045, BH046
	Hordeum jubatum c.t.	WETLAND	-	BH042, SC015
	Juncus balticus p.a.	WETLAND	G5/S4	BH031
	Puccinnellia nuttalliana p.a.	WETLAND	-	BH026, BH041, BH043
	Scirpus pungens p.a.	WETLAND	G4/S3	BH034

Figure 3. Vegetation of the Alkali Lake Area

LEGEND - Vegetation Mapping Units

1 - Dense clay range site (*Agropyron* series and lowland inclusions)
2 - Other range sites (*Stipa* series)
3 - Spring-fed wetlands
4 - Drained wetland
5 - Open water
6 - Tame grass

Scale 1:24000

VEGETATION DESCRIPTIONS: SHRUBLAND TYPES

Atriplex gardneri p.a. (G3G5/S3)

(ATRGAR; Nuttall'ssaltbush plant association; 2 plots)

Environment: ATRGAR is highly restricted in the study area as low-lying playa shrubland, located on what had once been isolated isthmuses between lakes and wetland. It is nearly level (0-2% slope), and the location is near the center of an area where salts accumulate in what had been nearly a closed basin watershed.

Soils: The Playa soils mapping unit is strongly alkaline clay soil (USDA 1980) and are entisols. The water table is shallow because the sites are located only slightly above the lake level.

Vegetation: The sparse cover of shrubs is app. 20%. The variable grass composition associated with Nuttall's saltbush approaches or exceeds shrub cover and includes bottlebrush squirreltail (*Sitanion hystrix*), Nuttall's alkaligrass (*Puccinnellia nuttalliana*) and meadow barley *(Hordeum brachantherum)*, with lesser amounts of forb cover that includes prairie pepperweed (*Lepidium densiflorum*) and poverty-weed (*Iva axillaris*).

This type has been documented from the Pryor Mountains (Lesica and DeVelice 1993), and as an incompletely-defined type with various species of associated grass from badland slopes in northeastern Montana (DeVelice et al. 1995).

Sarcobatus vermiculatus-Atriplex gardneri p.a. (G4/S3)

(SARVER-ATRGAR; greasewood-Nuttall's saltbush plant association; 2 plots)

Environment: SARVER-ATRGAR is restricted to bands along a limited segment of the lakeshore. Its habitat is contiguous with but slightly elevated above the Gardner's saltsage plant association. The Playa soils mapping unit is said to sometimes form "small dunes of clay aggregates" (USDA 1980), and there is a distinctive mound relief of less than 1 m throughout this plant association with the shrubs concentrated on the mounds. The mounding pattern might be an artifact of grazing, or it might reflect an autogenic process.

Soils: The Playa soils are strongly alkaline clays, and this segment in particular has strong shrink-swell capacity that "seals over" to limit permeability. On the top of the "mounds" the dried soil surface has the irregular texture of bentonite. This setting has a greater depth to the water table than for the preceding plant association.

Playa soils are mapped as being much more extensive than the actual shrublands, for they include the gravel ridge inclusion at the west end of the isthmus, and a shrubless,

nearly barren band on the east side of Alkali Lake extending between the dike and the ditch where excavation material from the ditch may have been transported to create the dike.

Vegetation: Shrub cover is made up mainly of greasewood (*Sarcobatus vermiculatus*), and it approaches or exceeds 30%. The greasewood is restricted to the tops of the "mounds" in the local microtopography, but it is not known whether this distribution pattern is cause or effect. The canopy cover of grasses is very low (around 10%), and the composition usually includes Nuttall's alkaligrass (*Puccinnellia nuttalliana).*

This type has not been documented from lakeside settings in Montana, but is related to the geographically-restricted community documented in the southwesternmost corner of Saskatchewan (Dodd 1966) and which barely enters the northwest corner of North Dakota.

VEGETATION DESCRIPTIONS: UPLAND GRASSLAND TYPES

Agropyron smithii - Poa juncifolia p.a. (G2/S2)

(AGRSMI-POAJUN; western wheatgrass - alkali bluegrass plant association; 3 plots)

Environment: AGRSMI-POAJUN p.a. is the prevalent community across gently-sloping uplands on the eastern and southern sections of the area.

Soils: Vanda Clay Series (USDA 1980) is the substrate for this plant association. Soils are derived from shale alluvium, and have high bicarbonate concentrations at all levels. They typically form a hard surface crust, have hard granular and blocky soil structure with moderate alkalinity in the A horizon, and a very plastic and sticky C horizon with zones that are strongly alkaline (USDA 1980).

Vegetation: This is the most extensive plant association in the area, prevalent on the east and south sides with diffuse gradients to other types. It has 30-50% canopy cover made up primarily of western wheatgrass, followed by alkali bluegrass. The depauperate forb cover includes the ubiquitous poverty-weed (*Iva axillaris*), sometimes accompanied by Richardson's hymenoxys (*Hymenoxys richardsonii)*, turpentine cymopterus (*Cymopterus terebinthus)* and south-wind flax (*Linum australe).*

This type is characterized as recurrent in depressions and alluvial flood plains in the driest parts of Saskaatchewan (Dood and Coupland 1966), but there are few other places with this association apart from Alkali Lake that have been documented elsewhere. It is remarkably free of exotic species. Musk thistle (*Carduus nutans*), is becoming established along a couple cattle trails at the north end. Musk thistle is usually a biennial that might be brought under control if prevented from flowering for

two+ years. It is not known whether it forms a seedbank. This community and adjoining wetland communities often have tine-leaved milkvetch (*Astragalus bisulcatus*) present. In some places it is locally common. It is a primary selenium accumulating species but is usually nonpalatable because of high selenium content (James and Shupe 1984).

Agropyron smithii - Stipa viridula p.a. (G4/S4)

(AGRSMI-STIVIR; western wheatgrass - green needlegrass plant association; 1 plot)

Environment: AGRSMI-STIVIR p.a. is an upland grassland positioned higher on the catena above the preceding association. It is best-developed along part of the perimeter on the east side.

Soils: It is associated with the soils mapping units that are on the fringes of the area, including the Linnett clay, 0-2% slope, and perhaps the Pendroy clay, 0-2% slope.

Vegetation: Total cover is well-above 50%, while the contribution of green needlegrass is low; estimated at a trace in the one plot taken during this study. Green needlegrass did not appear to have significantly higher cover than other graminoids (*Koeleria macaranthera, Poa secunda, Carex stenophylla*). The forb composition included higher cover values for Hood's phlox (*Phlox hoodii*), gumweed (*Grindelia squarrosa*) and broom snakeweed (*Gutierrezia sarothrae)* than found in other local plant communities. This vegetation is characterized as a clayey range site as opposed to the more widespread dense clay range site (USDA 1980). It has been suggested that this type was common in northeastern Montana but was favored for conversion to cropland (DeVelice et al. 1995).

Agropyron smithii - Bouteloua gracilis p.a. (G5/S4)

(AGRSMI-BOUGRA; western wheatgrass - blue grama plant association.; 1 plot)

Environment: AGRSMI-BOUGRA p.a. is on nearly level uplands and terraces.

Soils: The only expression of the association is found on Pendroy clay, 0-2% slope, the clay soil that is the most well-drained in the study area. This is perhaps the most arable soil unit in the study area.

Vegetation: This grassland type may intergrade with the AGRSMI-STIVIR p.a. and there is inadequate data and observation for merging or splitting it in the study area. It is recognized as a discrete association in the region, but may be an ecotone or a phase on site. Grass cover of 40-60% includes western wheatgrass, blue grama, green needlegrass, and traces of others. The fact that it has greater green needlegrass cover

than the previously-mentioned western wheatgrass - green needlegrass p.a., suggesting that it may be a phase of this association. Forbs include red globe-mallow (*Sphaeralcea coccinea*) in higher cover values than elsewhere in the area, as well as Hood's phlox (*Phlox hoodii*). This is also the only setting in which sweetclover (*Melilotus officinalis*) is presently found.

Stipa comata - Bouteloua gracilis p.a. (G5/S5)
(STICOM-BOUGRA; needle-and-thread - blue grama plant association; 2 plots)

Environment: STICOM-BOUGRA p.a.is found in well-drained slopes, terraces and ridges that are in the north and northwest parts of the study areas. Elsewhere in the plains, it is typical of glacial deposits (DeVelice et al. 1995).

Soils: Cabba loams (8-35% slope, hilly) derived from both sandstone and shale make up most or all of the soils for this type. The best-developed examples had loamy soils with a distinct fine sand texture. One of the study plot (#030) was in an area mapped as Kiev gravelly loam, 4-8% slope, where it was not the prevalent type but found in the most exposed of local settings.

Vegetation: This upland grassland association has similar or lower productivity than the wheatgrass types, but 2-3X greater species diversity. The mid- and short-stature grasses total canopy cover values less than 50%. Junegrass and fringed sage (*Artemisia frigida*) are common. The forbs that are locally restricted to this type include dotted blazing star (*Liatris punctata*), plains orophaca (*Astragalus gilviflorus*), and yellow buckwheat (*Eriogonum flavum*). The largest population of contracted indian ricegrass (*Oryzopsis contracta*) found in the study area occurred in this habitat.

There were small inclusions of rough fescue (*Festuca scabrella*) grassland on north-facing slopes that were too small to sample. These mesic slopes provided habitat to grass and forb species found nowhere else in the study area.

Stipa comata - Carex filifolia p.a. (G5/S4)
(STICOM- CARFIL; needle-and-thread - needle-leaved sedge plant association; 2 plots)

Environment: STICOM-CARFIL p.a. occur on lowland and mid-slope non-alkaline settings correspond with dissected fans and terraces on the north and west sides. In the Alkali Lake area, it tends to be at lower elevations.

Soils: Soils are Kiev gravelly loam, 4-8% slope.

Vegetation: Graminoid cover is less than 50%, with the majority made up of needle-

and-thread most of the rest by thread-leaved sedge and Junegrass. This association has segments with high cover of fringed sage (*Artemisia frigida*) and of south-wind flax (*Linum australe*).

Rabbitsfoot crazyweed (*Oxytropis lagopus* var. *conjugens*) and the smaller of the two populations of contracted indian ricegrass (*Oryzopsis contracta*) were documented in this association.

***Stipa comata - Stipa viridula* p.a. (-)**
(STICOM-STIVIR; needle-and-thread - green needlegrass; 1 plot)

Environment: STICOM-STIVIR p.a. is a localized mesic hillslope community on the west side uplands.

Soils: Soils are part of the Cabba loam, 8-35% slope unit, in localized areas with subirrigated conditions or a somewhat sheltered aspect. The soil texture has high permeability compared to others on-site, and the slope is relatively steep, so this is the most mesic grassland type of those sampled.

Vegetation: Grass cover is around 50%, split between the needlegrass co-dominants. This is the only community in which the native wavy-leaved thistle (*Cirsium undulatum*) was found, far-removed from the weedy species of thistle. This is almost the only place where prairie rose (*Rosa arkansana*) grows in the area.

VEGETATION DESCRIPTION: LOWLAND AND WETLAND TYPES

***Agropyron smithii* p.a. (G4/S3)**
(AGRSMI; western wheatgrass plant association; 2 plots)

Environment: AGRSMI p.a. occurs in wet meadow settings as well as uplands of the Great Plains; and the species is a facultative wetland species (USFWS 1993, Hanson et al. 1995). In the Alkali Lake area, it is located on flats near the shoelines, a diffuse gradient between wetland and upland. It is temporarily inundated in the spring and may pond rainwater after rainfall events at other times of the year.

Soils: It is a localized vegetation type that is best-developed and most extensive where Vanda clay and wetland soils come together; also making up the nearest semblance of wetland vegetation for much of the shorelines around the lake.

Vegetation: AGRSMI p.a. is a low-diversity association with no unique components and few species. Grass cover is 20-30%. Poverty-weed (*Iva axillaris*) makes up at

least another 10% of cover. This is the plant association that is most vulnerable to Canada thistle invasion, as seen in a fenced area where it forms dense swards along the southeast shore of the north lake.

This vegetation type occurs in nearly pure stands and is recurrent in swales and alluvial terraces of central and eastern Montana (Hanson et al. 1995) and southwestern Saskatchewan (Dodd and Coupland 1966).

Carex sartwellii (-)

(CARSAR;Sartwell's sedge plant association; 1 plot)

Environment: The CARSAR community occurs at the deep end of a spring-fed wetland, 10-20 cm deep. The shallow end of the community was dominated by *Juncus balticus*.

Soils: Soils are black muck, mapped simply as wetland.

Vegetation: At least 70% cover was provided by Sartwell's sedge. Associated species overlap with that of the Baltic rush community, and include sharp bulrush (*Scirpus pungens*), seaside arrowgrass (*Triglochin maritima*), Baltic rush (*Juncus balticus*), tufted hairgrass (*Deschampsia cespitosa)*, and foxtail barley (*Hordeum jubatum*).

This type has not been reported before in the classification literature so it will be noted for further review and prospective study elsewhere. The Sartwell's sedge is a minor component noted in other types for Montana (Hanson et al. 1995) and in the Prairie Pothole Region of North Dakota (Stewart and Kantrud 1973).

Deschampsia cespitosa p.a. (G4/S4)

(DESCES; tufted hairgrass plant association; 1 plot)

Environment: DESCES p.a. is above the mouth of the largest natural inlet into Alkali Lake. It makes up an emergent community in standing shallow water (10 cm), but is usually a community type of montane meadows. The water was extremely cold, probably from a spring source feeding into Rocky Ridge Coulee. This watercourse appears to be natural, and it is likely to represent among the least saline surface water in the study area apart from the gullied inlet that directly connects the Badger Fisher canal with the north lake.

Soils: This localized expression of DESCES remains as an emergent community with standing water for most or all of the summer. Soils information is not available, but the area had a clay bottom and litter build-up was evident.

Vegetation: Tufted hairgrass cover is about 50%, and Sartwell's sedge (*Carex sartwellii*; 20%) also has high cover. A diminutive spikerush (Eleocharis acicularis?), foxtail barley (*Hordeum jubatum*), and gumweed (*Grindelia squarrosa*) were the only other major components of this community. It is reminiscent of the tufted hairgrass meadows bordering ponds at higher elevations (Lesica 1989), and markedly different than the montane community described in Hanson et al. (1995).

***Distichilis stricta* p.a. (G4/S4)**

(DISSTR; inland saltgrass plant association; 1 plot)

Environment: DISSTR p.a. occurs in localized salt-accumulating zones bordering the ephemeral tributaries above the lakes. It is in arid-looking bands and patches that hardly look like wetlands, but subsurface moisture was present in mid-summer and the habitat is sometimes inundated in spring.

Soils: It was observed in both the "Saline land unit" and the Asbher complex, made up of clay soils. White salt accumulation is evident on the surface and made all the more conspicuous because the plant cover is sparse. Anaerobic conditions are often found in these settings.

Vegetation: The halophytic vegetation is dominated by inland saltgrass cover of ca. 10%, accompanied in trace amounts by species like Nuttall's alkali grass (*Puccinnellia nuttalliana*), seaside arrowgrass (*Triglochin maritimum*), and Russian thistle (*Salsola kali*).

***Hordeum brachyantherum/Iva axillaris* c.t. (-)**

(HORBRA; meadow barley - poverty-weed community type; 4 plots)

Environment: HORBRA/IVAAXI p.a. is located east of Alkali Lake in low-lying flats. These wetland flats are not mapped on the 1985 topographic map (Flag Butte 7.5') but are apparent on the aerial photographs maintained by the Blackfeet Tribe and as a subtle feature on the ground. The wetland flats are crossed by a deep drainage ditch connecting Alkali Lake with the Rocky Ridge Coulee, and which would be expected to eliminate any periods of standing water if not lower the water table, despite the low soil permeability.

Soils: The soils are not mapped on the current county soil survey because the aerial photo in that survey showed it as being underwater.

Vegetation: Vegetation cover of meadow barley ranged from 15-50%. The only other grass to contribute significantly to cover in one of the four plots was Nuttall's alkaligrass.

At the north end of its wetland habitat, it grades gradually into shrubland, and some plots were placed in settings which were subsequently interpreted to represent ecotones. Poverty-weed was consistently present and provided 10% or greater cover.

Since the local distribution of HORBRA/IVAAXI p.a. lies within the boundaries of the partially-drained wetland, it is considered likely to represent a successional community type that may be associated with disturbed settings.

Hordeum jubatum c.t. (-)

(HORJUB; foxtail community type; 2 plots)

Environment: HORJUB c.t. is the prevalent remaining shoreline plant association. The two plots were sampled on either side of the shallow drained wetland. It is also found on the south shores of the north lake. The lower reaches of it on the north lake remained partially submerged. It is typically a community type of temporarily inundated conditions, i.e., the "drawdown zone" of moderately saline or brackish water (Hanson et al 1995).

Soils: Soils are seasonally-wet, alkaline and clay. Its present distribution corresponds to the shoreline settings where the soils are mapped as Playa.

Vegetation: Canopy cover by foxtail barley varies greatly from 10% to over 40%. It is ordinarily considered to be a successional community type, and is tolerant of saline shoreline conditions ordinarily subject to period flooding and dessication. It occurs on the shorelines of the partially-drained wetland, where it was associated with trace amounts of greasewood and Gardner's saltsage, often with significant cover of Nuttall's alkaligrass (*Puccinnellia nuttalliana*); plus tine-leaved milkvetch (*Astragalus bisulcatus*), sow thistle (*Sonchus uliginosus*), and goat'sbeard (*Tragopogon dubius*). On the exposed shores of the north lake, it was associated with poverty-weed (*Iva axillaris*) and Canada thistle (*Cirsium arvense*). On the submerged shores of the north lake, it was associated with quillwort (*Isoetes* spp.), spikerush (*Eleocharis* spp.) and narrowleaf waterplantain (*Alisma gramineum).* It is similar, though without the full complement of halophytic associated species, in the vegetation types described by Dodd and Coupland (1966) and Lesica (1989).

Juncus balticus p.a. (G5/S4)

(JUNBAL; Baltic rush plant association; 1 plot)

Environment: While this plant association is widespread in many areas of the region and continent, it was found as a localized dominant in only one of the spring-fed wetlands in the north end. Shallow, standing water was present in mid-summer. It was

the largest of spring-fed wetlands in the north end, and the wetland had one end with deeper water dominated by *Carex sartwellii*.

Soils: The soils are mapped simply as "wetland". They are among the few wetland settings with black color that indicates muck development.

Vegetation: Baltic rush made up around 50% cover, and tufted hairgrass made up at least 10%. It is possible that this community is a grazing disclimax as observed elsewhre (Hanson et al. 1995) even though the ground was not hummocky from grazing. The composition resembles that for grazed tufted hairgrass meadows described by Lesica (1989). Associated species included wooly sedge (*Carex lanuginosa)*, silvery cinquefoil (*Potentilla anserina)*, and many-fruited sedge (*Carex praegracilis*).

Puccinnellia nuttalliana p.a. **(-)**
(PUCNUT; Nuttall's alkaligrass: 3 plots)

Environment: PUCNUT is a well-developed vegetation zone near shorelines with high salt accumulation, a saline meadow community located close to wetlands. It is extensive on the west side of Alkali Lake and is also present at the northeast corner of the wetland remaining in Sec. 31. It is more salt-tolerant than the HORJUB p.a. and in a temporarily inundated setting with wetter soils than the DISSTR p.a.

Soils: Soils are not mapped but are located on the perimeter of the unlabelled areas of open water, adjoining at least the Saline land unit and Vanda clay in Section 31.

Vegetation: Nuttall's saltgrass makes up 20-30% canopy cover, with or without significant contributions by inland saltgrass (*Distichilis stricta*) and foxtail barley (*Hordeum jubatum*). Dodd and Coupland (1966) found the Nuttall's alkaligrass and inland saltgrass to occur more often and extensively together as an ecotone than the two plant associations apart. In the study area it is a low-diversity association and the only forb consistently found with it is poverty-weed (*Iva axillaris).* In contrast, it was characterized as having a relatively high number of associated species among saline vegetation types in Saskatchewan (Dodd and Coupland 1966).

Note: PUCNUT p.a. is documented as a plant association in the Canadian literature under the synonym for its species' name, *Puccinnellia airoides* (Dodd and Coupland 1966). The results from this study will be used toward an expanded plant community classification and status review.

Scirpus pungens p.a. (G4/S3)
(SCIPUN; plant association: 1 plot)

Environment: This plant association was found in three different settings: a small seep-fed wetland in Sec. 24, the dried emergent flats of the remaining wetland in Sec. 31, and at the mouth of the two largest natural inlets on both lakes, extending for short distances into the lakes.

Soils: The substrates are in areas labeled as wetland or unlabeled open water areas.

Vegetation: SCIPUN contributes cover values ranging from 20-50%, with the highest values in the a small spring-fed wetland. Associated species include common spikerush (*Eleocharis palustris*) and shore buttercup (*Ranunculus cymbalaria).*

There were also trace amounts of a closely-associated species, alkali bulrush (*Scirpus maritimus*) growing in the lake. This is a species of considerable interest because it has high food value for waterfowl and other wildlife (Kantrud 1996). Elsewhere in the plains, plant associations of both alkali bulrush and sharp bulrush are often observed in the same locales, and the alkali bulrush p.a. is in deeper water (Hanson et al. 1995). Windrows of alkali bulrush corms (the underground storage organs) lined the south shore of the remaining wetland in Sec. 31. It is hypothesized that the dike separating Alkali Lake from the remaining wetland in Sec. 31 has cut off the major water source for the wetland, converting a deep-marsh community of alkali bulrush to a shallow, unvegetated wetland that now has more bare shore than prior to dike construction. An area of emergent vegetation appearing on the USDA soil survey aerial photos (1980) is absent under present conditions and may also have been an alkali bulrush community.

Saline Open Water and Associated Habitats

Environment: The study area has ca. 1,600 acres of alkali lakes located at the low point in the landscape. Emergent vegetation is scarce or wanting in both lakes, a condition that is usually taken to reflect strongly brackish, subsaline or saline water conditions. Water chemistry tests have been conducted on lake waters elsewhere in the northern Great Plains to characterize the likely range of conditions (Rawson and Moore 1944, Stewart and Kantrud 1973) but were not conducted on-site.

Additional inferences can be made about water chemistry from observation. The open waters of the two study area lakes have abundant sago pondweed (*Potamogeton pectinatus*), which typically assumes dominance under moderately brackish and brackish conditions, but drops out under subsaline and saline conditions. This is consistent with its patterns of dominance at alkaline wetlands that were studied to the west (Lesica 1989). Most alkali lakes are shallow, change drastically in water chemistry

conditions over the growing season, and may evaporate in dry years (Kantrud et al. 1989), but there was no evidence of this seasonal fluctuation at Alkali Lake due to the inflow from the canal.

Soils: The lakebed substrate is made of unconsolidated clay sediments that are readily stirred by winds, accounting for high turbidity. Saline lake shorelines are characterized as having low sedimentation and organic matter production rates, permanent high, saline water tables, and periodic disturbance by wave action to retard soil development (Arndt and Richardson 1988).

Vegetation: Windrows of once-submerged vegetation were examined along Alkali Lake. Sago pondweed (*Potamogeton pectinatus*) was observed. This is consistent with the highest alkalinity conditions encountered by Lesica (1989). Emergent vegetation is scarce (see *Hordeum jubatum* c.t. and *Scirpus pungens* p.a.).

Open shorelines occur along limited parts of the north lake shore, and along the southern border of the southeastern wetland. Much of what appears as open lakeside shoreline on aerial photographs is in fact sparsely vegetated, usually by foxtail barley (*Hordeum jubatum).*

The typical vegetation of saline lakeshore flats includes red glasswort (*Salicornia rubra*; Dodd and Coupland 1966). The red saltgrass p.a. has been characterized for Montana as occupying the "drawdown zone" of saline wetlands (Hanson et al. 1995), i.e., temporarily inundated until late spring. Red glasswort was not found in the study area, though it is known from the vicinity (Lesica 1989) and may be present in low numbers. It was observed as a frequent component of the shorelines at piping plover nesting locations in other prairie pothole systems (Heidel pers. obs.) where it forms a shoreline plant association that is often interrupted by flat, barren expanses, well above the "drawdown zone" and exposed through all times of year including the nesting season. It is not the nesting habitat for the piping plover but is often intermingled with it.

To understand what is natural in shoreline conditions requires information on natural water levels. The north lake shows at least two abandoned beach lines on the ground and on aerial photo that testify to higher water conditions in the past compared to the present. The south lake shows active cutbank erosion testifying to lower water conditions in the past compared to the present. Comparison of current vegetation and soil conditions, examination of pre-1970 aerial photographs, and interview with people who personally know the setting over time may help reconstruct the natural shoreline conditions.

In addition, there was one island in the north lake under 1996 water level conditions. Islands are generally attractive for shorebird and waterfowl nesting because they are free of mammalian predators. The island in the north lake appeared to be covered by

dense vegetation without any bare shore, but was not visited for the purposes of this study. It has been noted elsewhere that burning off the herbaceous vegetation on the islands before return of piping plovers has fostered successful piping plover nesting, even though these islands became densely vegetated later in the growing season (Smith pers. commun.).

Botanical Results

The rare wetland plant species of the Great Plains were not found. Instead, two upland species that are regional endemics of the northern Rocky Mountains and which had once been recognized as species of special concern were documented: contracted indian ricegrass (*Oryzopsis contracta*) and rabbit-foot crazyweed (*Oxytropis lagopus* var. *conjugens*). Their local distribution is indicated in Figure 4. Both are limited in their worldwide distribution to an area less than half the size of Montana. The presence of contracted indian ricegrass (*Oryzopsis contracta*) signifies a major range extension about 300 miles north of previously-documented records. The presence of rabbit-foot crazyweed (*Oxytropis lagopus* var. *conjugens*) signifies an intermediate point between known populations in Montana and adjoining Alberta. The populations of both are small in the Alkali Lake area because the habitat is limited. Their presence has primarily biogeographical significance.

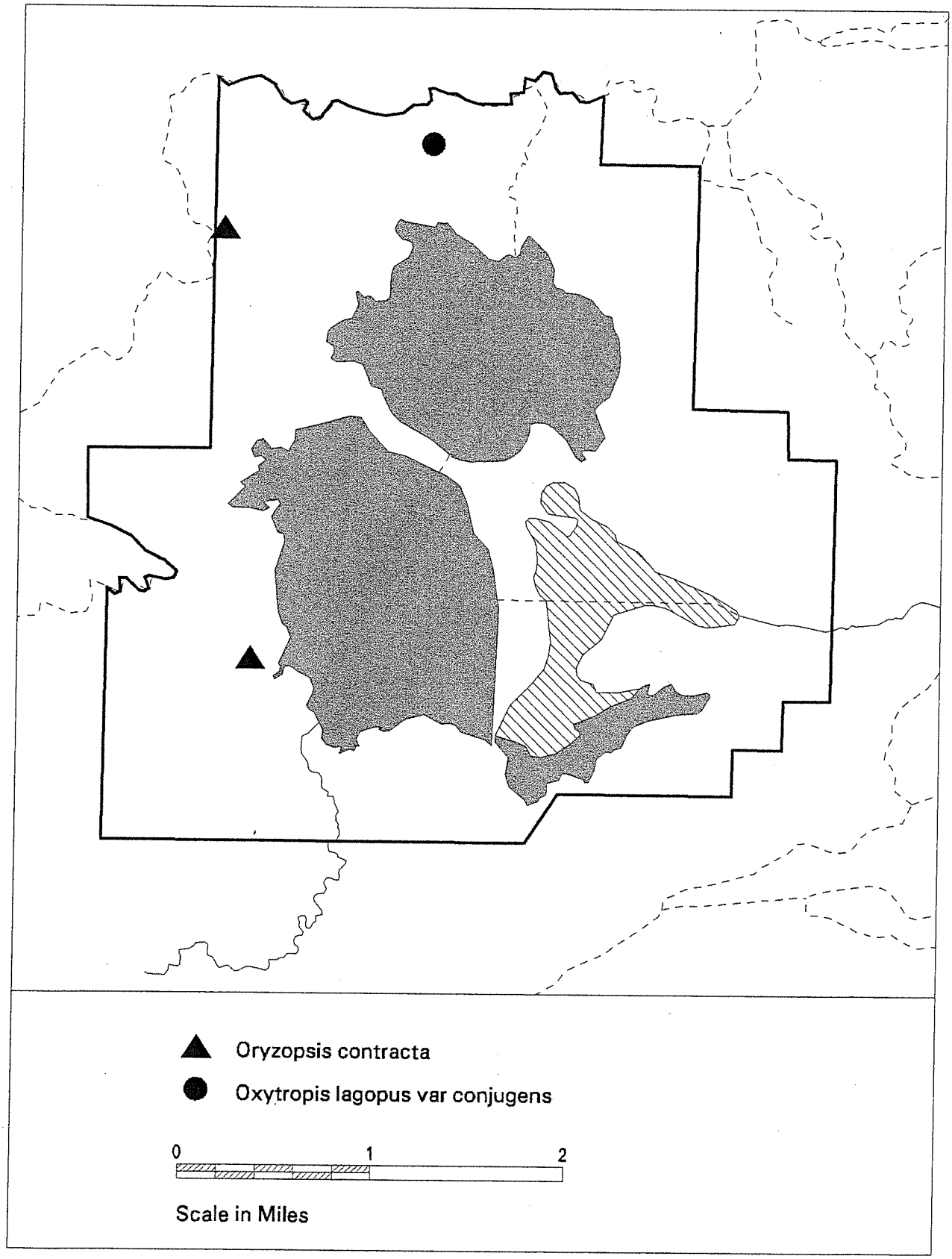
The specific substrates for the two rare wetland sedges were not present (coarse wetland soils for *Carex synchnocephala* and marl substrate for *Carex crawei*). The shallow wetland habitat of the other target species was not present.

A total of 166 vascular plant species were documented from the study area, as presented in Appendix A. Only seven are non-native. The landscape pattern is such that a few species are widespread, while many species are present in only trace amounts. The total number of species is relatively low for a large landscape, but the flora is representative for one that has pervasive saline conditions. The Alkali Lake area species richness is augmented by the non-saline segments of the western uplands.

The flora is predominantly made up of Great Plains species and ubiquitous aquatic species, with a trace component of Rocky Mountains and Great Basin species. Culturally significant plants have not been evaluated as part of this study to date.

The following pages provide a summary of information on *Oryzopsis contracta* and *Oxytropis lagopus* var. *conjugens*.

Figure 4. Plant Species of Special Interest at Alkali Lake



Montana Natural Heritage Program, June 10, 1997

Oryzopsis contracta (Johnson) Shechter
CONTRACTED INDIAN RICEGRASS
Grass Family (Poaceae)

Note: The following information represents a compilation of new information gathered at Alkali Lake and two separate 1996 field projects.

CONSERVATION STATUS

U.S. Fish and Wildlife Service: None. It was once listed as a Category 2 (C2) species by the USDI Fish and Wildlife Service (1993), but recommended moved to Category 3C because it was not in jeopardy based on survey and herbarium studies in Wyoming which documented a broad distribution and limited degree of threat. The Category 2 list was discontinued by the U.S. Fish and Wildlife Service (1996) before any changes were made to the species' status.

State rank: Prior to this study it was ranked G3 SU (globally vulnerable; state status undetermined). The first survey to address it in 1995 indicated that it had been overlooked rather than being imperiled (Heidel and Vanderhorst 1996). This study in concert with other 1996 studies are summarized by Vanderhorst et al. (1997) and they support reranking the species to S3 (vulnerable in the state), and moving it to the watch list. Distribution information will still be collected for it, and its status will be re-evaluated should there be evidence of decline.

While this species is no longer treated as a Montana Species of Special Concern, it is on the watch list as a regional endemic, and as such lends to the biogeographic significance of the study area.

DESCRIPTION: Contracted indian ricegrass is a tufted perennial with glabrous stems 30-65 cm (12-28 inches) tall. The inflorescence is a panicle with branches that are initially contracted (hence the common name) but which become stiffly spreading at maturity. Spikelets are 1-flowered, slender, and app. 1 cm (3/8 inch) long. The lemmas are covered by short, white, silky hairs that do not exceed the lemma; the lemmas have an awn 6-12 mm (1/4-1/2 inches) long (from Fertig 1994, Wyoming Rare Plant Technical Committee 1995).

Oryzopsis contracta can be recognized by its contracted or stiffly spreading panicle branches, often with perpendicular pedicel angles, slender-shaped spikelets, and long-awned lemmas with short, silky white hairs. These hairs are equal or less than the length of the lemma (Fertig 1994). It was initially described as a variety of *Oryzopsis hymenoides* (Johnson 1945) which it most closely resembles. A more detailed study by Shechter and Johnson (1966) led to recognition of this grass as a distinct species. It is intermediate between *Oryzopsis hymenoides* and *O. micrantha*, and is likely to have been overlooked or misidentified in Montana because of its resemblance to the other

Figure 5. Contracted indian ricegrass illustration

Illustrated by Isobel Nichols
From Fertig 1994

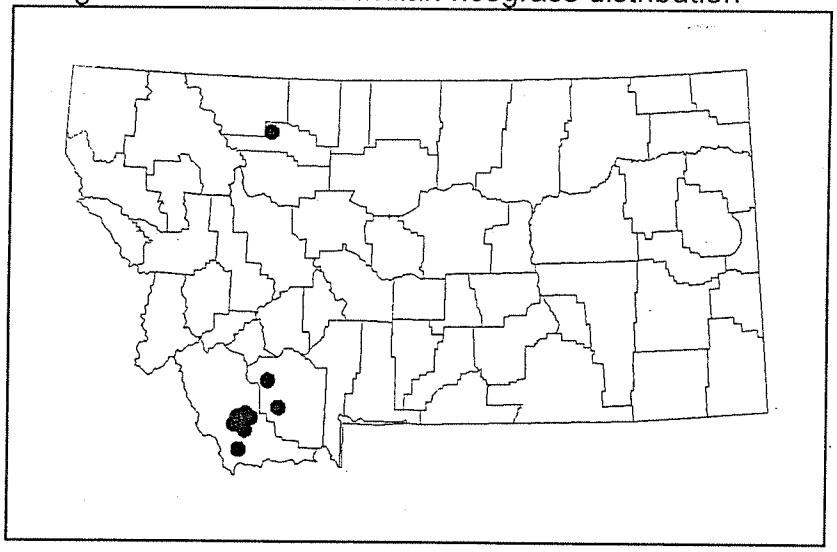
species and its habitat overlap. Common indian ricegrass (*Oryzopsis hymenoides*) differs from *O. contracta* in having a wide-spreading, wavy-branched panicle, plump florets, lemmas with relatively short awns (usually <6 mm), and long silky hairs that exceed the body of the lemma (Wyoming Rare Plant Technical Committee 1994). The pedicel angles of branching are noticeably different in the field, providing a quick basis for making distinctions when matured inflorescences are present. Littleseed ricegrass (*Oryzopsis micrantha*) is distinguished by having glabrous lemmas and strictly contracted panicle branches.

GEOGRAPHICAL DISTRIBUTION

Global distribution: *Oryzopsis contracta* is a regional endemic of the Rocky Mountains with its center of distribution across central and western Wyoming, extending into north-central Colorado and southwest Montana (Fertig 1994). Its discovery at Alkali Lake in 1996 represents a major 300 mile northward extension of its known distribution.

Montana distribution: *Oryzopsis contracta* is currently known from three counties: Beaverhead and Madison Counties in southwestern Montana and Pondera County in northern Montana (see state distribution map). It was first recognized as part of the Montana flora when an herbarium specimen deposited at the Rocky Mountain Herbarium in Laramie, WY which had been originally identified as *Oryzopsis hymenoides* was annotated by Walter Fertig (Wyoming Natural Diversity Database) to *O. contracta*.

Figure 6. Contracted indian ricegrass distribution



Local distribution: Two populations were documented on the west side of Alkali Lake in small patches within T.31N R.7W Sec. 23 SW 1/4 of NE 1/4; and in T.30N R.7W Sec. 2 NE 1/4 of NW 1/4.

HABITAT: The Alkali Lake habitat is found in small areas of the uplands that have coarse soil texture and are not strongly alkaline. One site is located on a ridgetop, while the other is situated on a gravelly lacustrine deposit close to the shoreline.

In Wyoming, its habitat is summarized as dry, shallow, sandy, or gravelly soils on slopes or rolling plains in open, sagebrush-grassland communities (Fertig 1994). This broad range of habitats is reflected among the known Montana occurrences, which are generally in foothills and montane settings at a range of 3890-7000 ft. While the substrates and settings vary, they are usually habitats or microhabitats where the vegetation is sparse. The two places where it was found at Alkali Lake were both well-drained settings, but the large northern place was a loam with fine sand on one of the highest ridges locally, while the second was on gravelly silt in a localized band near the Lake. Soils are consistently well-drained and light-colored, often with little or no profile development. They are derived from a wide variety of parent materials including Madison Group limestone, siltstone, alluvial gravel or sand, and quartzite.

The associated vegetation at Alkali Lake is dominated by needle-and-thread (*Stipa comata*), variously co-dominated by blue grama (*Bouteloua gracilis*), western wheatgrass (*Agropyron smithii*), and thread-leaved sedge (*Carex filifolia*). Commonly associated species in these settings include fringed sage (*Artemisia frigida*) and tufted milkvetch (*Astragalus gilviflorus*). Elsewhere in Montana, it is in grassland and steppe dominated by bluebunch wheatgrass (*Agropyron spicatum)*, with or without Wyoming sage (*Artemisia tridentata* var. *wyomingensis),* and less often with black sage (*Artemisia novum).*

The following composite list of associated species in Montana reflects major differences between the three counties where it has been recently documented. The plants present in the Alkali Lake area are marked by " ^ ", while species marked by " * " are found in the Ruby Range, and the species marked by "+" are found in Beaverhead County. Most species on this list are associated with *Oryzopsis contracta* in only one of the three counties, further evidence that this species has broad ecological amplitude.

Scientific name	Common name
*Agropyron smithii^*	*western wheatgrass*
Agropyron spicatum+*	*bluebunch wheatgrass*
*Allium textile**	*textile onion*
Arenaria kingii+	*King's sandwort*
Artemisia arbuscula+	*low sagebrush*
Artemisia frigida+	*fringed sage*
Artemisia tridentata var. wyomingensis+	*Wyoming big sagebrush*
Aster scopulorum+*	*crag aster*
*Astragalus gilviflorus^*	*plains orophaca*
*Astragalus pectinatus^*	*tine-leaved milkvetch*
*Astragalus vexilliflexus**	*bent-flowered milkvetch*
Atriplex gairdneri^*	*Gardner's saltsage*
*Bouteloua gracilis^*	*blue grama*
Bromus tectorum+	*cheatgrass*

Carex filifolia^	*thread-leaved sedge*
*Chrysothamnus nauseosus**	*common rabbitbrush*
*Commandra umbellata**	*bastard toad-flax*
Cordylanthus ramosus+	*bushy birdbeak*
Erigergon cespitosus^	*tufted fleabane*
*Erigeron ochroleucus var. scribneri**	*buff fleabane*
Eriogonum flavum^	*yellow buckwheat*
Galium boreale^	*northern bedstraw*
*Gutierrezia sarothrae**+	*broom snakeweed*
Hymenoxys richardsonii^	*Richardson's hymenoxys*
*Koeleria macranthera**	*junegrass*
*Lesquerella alpina**+	*alpine bladderpod*
Linum australe^	*south-wind flax*
*Linum lewisii**	*wild blue flax*
Melilotus officinalis^	*yellow sweetclover*
Oenothera cespitosa^	*desert evening-primrose*
Oryzopsis hymenoides+	*common indian ricegrass*
Paronychia sessiliflora^	*stemless whitlow-wort*
Phacelia linearis+	*threadleaf phacelia*
*Phlox hoodii**	*Hood's phlox*
Phlox longifolia+	*long-leaved phlox*
*Poa secunda**+	*Sandberg's bluegrass*
Stipa comata+	*needle-and-thread*
*Stipa viridula**^	*green needlegrass*
*Townsendia florifer**	*showy townsendia*

Note: The common indian ricegrass (*Oryzopsis hymenoides*) was present on the isthmus between the lakes, but the two species did not occur together at Alkali Lake.

POPULATION INFORMATION: Between 100-200 plants were observed in two separate areas along the western part of the study area. Plants were in low density and patchy. Though the western segment of the study area was not thoroughly searched, there is limited suitable habitat and the population numbers are magnitudes lower compared to the largest known population in the Ruby Range of Madison County.

Mature plants have 1-few stalks per basal tuft, and the basal tufts are taken to represent discrete bunchgrass individuals. In southwestern Montana, the spikes emerge and expand in mid-June, and the inflorescence retains most seeds into July but readily shed seeds once cured. In Pondera County, it appeared that plants were about three weeks later in phenology compared to southwest Montana.

MANAGEMENT CONSIDERATIONS: Like common indian ricegrass, contracted ricegrass is considered to be a decreaser under livestock grazing (Fertig 1994). Its presence is taken to indicate rangeland in fair or better range condition. It does not appear to be a good competitor, and exotic species invasion poses threats. Because of its low competitive ability, it occurs elsewhere at localized natural or unnatural settings for early plant succession e.g., around rock outcrops or along roadside rights-of-way.

Oxytropis lagopus Nutt. var. *conjugens* Barneby
RABBIT-FOOT CRAZYWEED
Bean Family (Fabaceae)

CONSERVATION STATUS

U.S. Fish and Wildlife Service: None.

Other: It is given a Priority 2 rating in Canada (Argus and Pryer 1990), and recommended for consideration as a vulnerable species (Smith 1994).

State rank: Prior to this study it was ranked G5T3 S3 (meaning that the variety is globally vulnerable, and the state status is vulnerable). It was taken off of the state species of special concern list in 1993 because, despite its narrow distribution, it is found in many places and it appears to increase under grazing pressure.

While this taxa is no longer treated as a Montana Species of Special Concern, it is on the watch list as a regional endemic, and as such lends to the biogeographic significance of the study area.

DESCRIPTION: Rabbit-foot crazyweed is a cespitose perennial with a short, branching woody stem at or below the surface. The foliage is densely silky-villous with long silvery hairs. The stipules are membranaceous and densely silky-pilose dorsally, sometimes glabrate with age. Leaves are 3-11 cm long usually 5-9 leaflets. Each leaflet is about the same length as the rachis rather than much shorter. Scapes are upright, 2-13 cm long. The racemes are 5-18 flowered. Bracts are shaggy-pilose dorsally, often with dark hairs. The calyx is 8-11 mm long, with silky hairs concealing the face of the tube which is turgid to inflated at anthesis. The corolla is pink-purple, 13-16 mm long. The keel is 11-14 mm. Long. The pod is erect, chartaceous to submembranaceous. The calyx is usually persistent until after the pod dehisces (from Hitchcock et al. 1984, Smith 1994).

Oxytropis lagopus var. *conjugens* can be recognized in part by its silky foliage. Its most diagnostic characteristic is that the maturing pod does not rupture the calyx. *Oxytropis lagopus* var. *atropurpurea* is another variety of the same species that is also present in Montana. But it is only known from southern Montana, has a deep purple flower color rather than a pinkish-purple, and usually has 11 or more leaflets, rarely as long as the calyx rather than 5-9 leaflets each of which is as long as the rachis.

Figure 7. Rabbit-foot crazyweed illustration

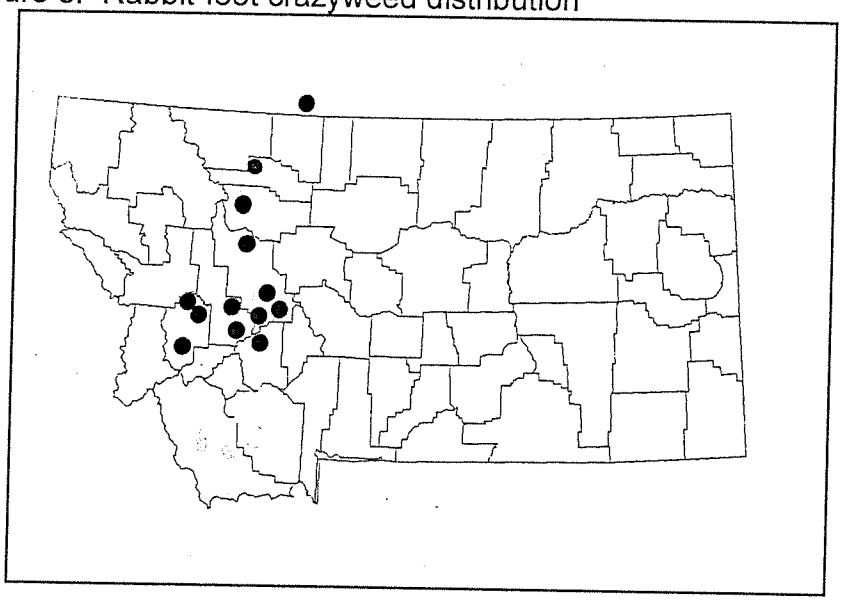
Illustrated by Jeanne Janish
From: Hitchcock et al. 1984

GEOGRAPHICAL DISTRIBUTION

Global distribution: *Oxytropis lagopus* var. *conjugens* was considered to be a Montana endemic until it was discovered in Alberta in 1986. There, it is only found in the western section of the North Milk River (Smith 1993).

Montana distribution: *Oxytropis lagopus* var. *conjugens* is currently known from seven counties in Montana: Granite, Jefferson, Lewis and Clark, Missoula, Pondera, Powell and Teton counties. The Alkali Lake site lies between the Alberta populations and the northernmost documented Montana population (see map).

Figure 8. Rabbit-foot crazyweed distribution



Local distribution: One population was documented on the north end of the area at a midslope bench in T.31N R.7W Sec. 13 SW1/4 of SE 1/4.

HABITAT: The Alkali Lake habitat is found in small areas of the uplands dominated by *Stipa comata - Carex filifolia*, on a midslope bench. Other associated species include silky crazyweed (*Oxytropis sericea)* androsh skeletonweed (*Lygodesmia juncea).* It is not readily discernible after it has flowered, so survey is not to be considered as complete for the study area.

Elsewhere it is found on sagebrush plains and grasslands to lower mountain slopes most often on calcareous, well-drained substrates.

POPULATION INFORMATION: Fewer than 10 plants were found in the area despite close inspection across the locale. Plants were solitary and sparse. Flowering takes place from mid May to mid June depending on location. At the time of the survey visit, fruits were mature and were beginning to dehisce.

MANAGEMENT CONSIDERATIONS: Rabbit-foot crazyweed is an increaser under grazing (Heidel pers. obs.) as is the crazyweed genus in general. Its rarity in the study area is taken to partially reflect favorable range conditions, and the low availability of suitable habitat.

Species of the crazyweed (*Oxytropis*) genus are considered undesirable by stockmen because they cause "locoism" which, in extreme cases, kill livestock. At Alkali Lake, the crazyweed species and this one in particular are present in trace amounts.

DISCUSSION

The Alkali Lake study area supports a relatively high number of wetland emergent vegetation types. They can be sorted mainly by water depth and salinity. Their acreage is very small compared to the open water habitat of the Alkali Lake complex. It is hypothesized that there has been loss of two additional wetland types from the area, the red glasswort p.a. (*Salicornia rubra* plant association) and the alkali bulrush p.a. (*Scirpus maritimus* plant association) due to changes in the water regime.

Efforts to alter saline wetlands often lead to increased salinization (Kantrud et al. 1989). Some segments of the Alkali Lake landscape have had artificially elevated water levels and others have had artificially lowered water levels. The geochemistry of saline soils has been characterized under natural conditions (Arndt and Richardson 1989) but the processes and outcome with hydrological changes are not as well known. At Alkali Lake, the salinization process has been offset in part by diverting water into the lake, and it has been constrained by the limited effectiveness of the new outflow ditch connecting Alkali Lake to the Rocky Ridge Coulee. Regional water management recommendations are beyond the scope of this study.

Noxious weeds are a secondary wetlands management concern because Canada thistle (*Cirsium arvense*) is invading potential piping plover shoreline habitat on the north lake. Its is in high density in only one area.

Terrestrial plant communities of the Alkali Lake system have been altered less than the aquatic ones. As such they augment the site values and partially buffer the aquatic features. The uplands represent productive rangelands in spite of the fact that extensive areas lack soil development or have high-salinity conditions. The eight upland plant associations are largely intact. The rarest among them is also the most extensive locally, the western wheatgrass-alkali bluegrass p.a. (*Agropyron smithii - Poa juncifolia* p.a.). It is part of the prevailing dense clay range site that can produce 900 pounds of air-dry herbage per acre in favorable years when in excellent condition (USDA 1980). The potential signs of range condition decline for this type are an increase in annual and unpalatable forbs. Most uplands are in at least good ecological condition and the overall trend is stable or improving under current management.

The high diversity of plant associations include range extensions (*Atriplex gardneri* p.a., *Deschampsia cespitosa* p.a.) and good examples of poorly-known types (*Agropyron smithii-Poa juncifolia* p.a., *Puccinellia nuttalliana* p.a.). The presence of two plant taxa endemic to the Northern Rocky Mountains (*Oryzopsis contracta*, *Oxytropis lagopus* var. *conjugens*) augments the regionally-significant botanical features of the Alkali Lake area. Alkali Lake provides a biological meeting grounds between the Great Plains and Rocky Mountains. This study of it provides a framework for re-examining the past and the present to set the course for the future.

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Appendix A - Preliminary list of vascular plants in the Alkali Lake area[1]

Scientific Name	Common Name
Achillea millefolium	yarrow
Agoseris glauca	pale agoseris
Agropyron cristatum*	crested wheatgrass
Agropyron dasystachyum	thick-spiked wheatgrass
Agropyrom smithii	western wheatgrass
Agroyron trachycaulum	bearded wheatgrass
Agrostis scabra	ticklegrass
Alisma gramineum	narrowleaf waterplantain
Allium cernuum	nodding onion
Allium textile	textile onion
Alopecurus pratensis	meadow foxtail
Androsace septentrionalis	northern fairy-candelabra
Antennaria corymbosa	meadow pussy-toes
Antennaria microphylla	rosy pussy-toes
Antennaria parvifolia	Nuttall's pussytoes
Arabis holboellii	Holboell's rockcress
Artemisia campestris	Pacific sagewort
Artemisia cana	silver sagebrush
Artemsiai frigida	fringed sagewort
Artemsia ludoviciana	prairie sagewort
Aster falcatus	white-prairie aster
Astragalus adsurgens	standing milk-vetch
Astragalus agrestis	field milk-vetch
Astragalus bisulcatus	two-groove milk-vetch
Astragalus crassicarpus	ground plum
Astragalus drummondii	Drummond's milk-vetch
Astragalus gilviflorus	plains orophaca
Astragalus pectinatus	tine-leaved milk-vetch
Astragalus spatulatus	draba milk-vetch
Astragalus tenellus	pulse milk-vetch
Atriplex argentea	silverscale
Atriplex gardneri	Gardner's saltsage (was A. nuttallii)
Bouteloua gracilis	blue grama
Camelina sativa*	gold-of-pleasure
Campanula rotundifolia	harebell
Carduus nutans*	musk thistle
Carex filifolia	thread-leaved sedge
Carex lanuginosa	woolly sedge
Carex nebrascensis	Nebraska sedge

[1]Plants which are not native are asterisked after their scientific names.

Carex praegracilis	clustered field sedge
Carex sartwellii	Sartwell's sedge
Carex stenophylla	narrow-leaved sedge
Carex utriculata	beaked sedge
Castilleja sessiliflora	downy painted cup
Chenopodium capitatum	strawberry blite
Chenopodium rubrum	red goosefoot
Cirsium arvense*	Canada thistle
Cirsium undulatum	wavy-leaved thistle
Cirsium vulgare*	bull thistle
Comandra umbellata	bastard toad-flax
Conyza canadensis	horseweed
Crepis atribarba	slender hawksbeard
Cryptantha watsonii	Watson's cryptantha
Cymopterus terebinthinus	turpentine cymopterus
Cynoglossum officinale*	northern hound's-tongue
Dalea candida	white prairie clover
Dalea purpurea	purple prairie clover
Deschampsia cespitosa	tufted hairgrass
Descurainia richardsonii	Richardson's tansymustard
Descurainia sophia	flixweed tansymustard
Distichilis strica	inland saltgrass
Elaeagnus angustifolia	silverberry
Eleocharis palustris	common spike-rush
Eleocharis spp.	spike-rush
Elymus macounii	Macoun wildrye
Epilobium paniculatum	autumn willow-herb
Erigeron cespitosus	tufted fleabane
Eriogonum flavum	yellow buckwheat
Erysimum repandum	spreading wallflower
Festuca idahoensis	Idaho fescue
Festuca scabrella	rough fescue
Gaillardia aristata	blanketflower
Galium boreale	northern bedstraw
Gaura coccinea	scarlet gaura
Geum triflorum	prairie smoke
Glaux maritima	sea milk-wort
Glycyrrhiza lepidota	wild licorice
Grindelia squarrosa	gumweed
Gutierrezia sarothrae	broom snakeweed
Haplopappus acaulis	cushion goldenweed
Haplopappus integrifolius	entire-leaved goldenweed
Hedysarum sulphurescens	yellow hedysarum
Heliotropium curassavicum	salt heliotrope
Heterotheca villosa	hairy golden-aster

Hordeum brachyantherum	meadow barley
Hordeum jubatum	foxtail barley
Hymenoxys richardsonii	Richardson's hymenoxys
Isoetes spp.	quillwort
Iva axillaris	poverty-weed
Juncus balticus	Baltic rush
Koeleria macrantha	junegrass
Lappula redowskii	western stickseed
Lepidium densiflorum	prairie pepperweed
Lesquerella ludoviciana	silvery bladderpod
Liatris punctata	dotted blazing-star
Linum australe	south-wind flax
Linum lewisii	wild blue flax
Lygodesmia juncea	rush-like skeletonweed
Machaeranthera canescens	hoary aster
Machaeranthera pinnatifida	spiny goldenweed
Medicago lupulina	black medic
Medicago sativa	alfalfa
Melilotus officinalis	yellow sweetclover
Mentha arvensis	wild mint
Monolepis nuttalliana	poverty weed
Musineon divaricatum	leafy musineon
Myriophyllum verticillatum	spiked water-milfoil
Oenothera cespitosa	desert evening-primrose
Oenothera villosa	common evening-primrose
Opuntia polyacantha	plains prickly-pear
Orobanche fasciculata	clustered broomrape
Orthcarpus luteus	yellow owl-clover
Oryzopsis contracta	contracted indian ricegrass
Oryzopsis hymenoides	common indian ricegrass
Oxytropis lagopus var. conjugens	rabbit-foot crazyweed
Oxytropis sericea	silky crazyweed
Oxytropis viscida	sticky crazyweed
Paronychia sessiliflora	stemless whitlow-wort
Penstemon nitidus	shining penstemon
Phleum pratense	timothy
Phlox hoodii	Hood's phlox
Plagiobothrys scouleri	Scouler's popcorn-flower
Plantago major	common plantain
Poa juncifolia	alkali bluegrass
Poa pratensis	Kentucky bluegrass
Poa secunda	Sandberg's bluegrass
Polygonum sawatchense	Sawatch knotweed
Populus angustifolia	narrowleaf cottonwood

Potamogeton pectinatus	sago pondweed
Potentilla anserina	common silverweed
Potentilla concinna	early cinquefoil
Potentilla gracilis	slender cinquefoil
Puccinellia nuttalliana	Nuttall's alkaligrass
Ranunculus circinatus	stiff-leaved water-buttercup
Ranunculus cymbalaria	shore buttercup
Ratibida columnifera	prairie coneflower
Rhus trilobata	skunk-bush sumac
Rosa arkansana	prairie wild rose
Rumex crispus*	curly dock
Rumex salicifoius	willow-leaved dock
Sagittaria cuneata	grassy arrowhead
Salix exigua	coyote willow
Salsola iberica	Russian thistle
Sarcobatus vermiculatus	greasewood
Scirpus maritimus	alkali bulrush
Scirpus pungens	sharp bulrush
Scirpus validus	softstem bulrush
Senecio canus	wooly groundsel
Senecio integerrimus	western groundsel
Sitanion hystrix	bottlebrush squirreltail
Solidago missouriensis	Missouri goldenrod
Sonchus asper	prickly sow-thistle
Sonchus uliginosus	marsh sow-thistle
Spartina gracilis	alkali cordgrass
Sphaeralcea coccinea	red globe-mallow
Stipa conata	needle-and-thread
Stipa viridula	green needlegrass
Taraxacum officinale	dandelion
Thermopsis rhombifolia	goldenpea
Townsendia hookeri	Hooker's townsendia
Tragopogon pratensis	goat's beard
Triglochin maritimum	seaside arrow-grass
Typha latifolia	cattail
Vicia americana	American vetch
Zannichellia palustris	horned pondweed
Zigadenus venenosus	meadow death-camas

Appendix B - Photographic records of the Alkali Lake area:

Alkali Lake
Typical ephemeral tributary to Alkali Lake
Gullied tributary connecting canal at north end
Cutbank shore along east margin of Alkali Lake
Remaining wetland system in southeast corner
ATRGAR p.a. (Plot #023)
SARVER-ATRGAR p.a. (Plot #022)
AGRSMI-POAJUN p.a.
AGRSMI-STIVIR p.a. (Plot #048)
AGRSMI-BOUGRA p.a. (Plot #028)
STICOM-BOUGRA p.a. (Plot #030)
STICOM-CARFIL p.a. (Plot # 036)
STICOM-STIVIR (Plot #037)
DESCES p.a. (Plot #038)
DISSTR p.a. (Plot #033)
HORBRA c.t. (Plot #044)
HORJUB c.t. (Plot #042)
JUNBAL p.a. (Plot #031)
PUCNUT p.a. (Plot #026)
SCIPUN p.a. (Plot #032)